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## THE QUANTITY THEORY AND RECENT STATISTICAL STUDIES

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Science is advanced by the process of criticizing theories in the light of experience and reflection. Recent price changes and the advance of statistical knowledge have subjected the quantity theory of money to a searching test, and much light has been thrown upon both its merits and its faults. It is possible now to draw certain conclusions that in part modify earlier formulations. This paper is an endeavor to summarize these conclusions.

In the first place, it has become clear that the formula<sup>1</sup>

$$P = \frac{MR + CR}{N}$$

is a truism as applied to a commercial system based upon a money and credit currency. Superficially, it does not need statistical verification any more than does a mathematical axiom. If an attempted verification failed, we might well trust the formula in spite of the apparent facts, just as a mathematician would be certain in the face of inaccurate measurements that the sum of the angles of a quadrilateral is equal to  $360^\circ$ . For all that the formula states is the axiomatic truth that the money and credit paid for goods, divided by the number of units bought, gives the average price of the goods. The mere fact that diverse units are involved creates no difficulty to anyone who is familiar with the process of finding price indices. As will be described later, the formula expresses merely a summarization of a series of the simplest kind of price computations. And if the validity of the equation of exchange is conceded, the quantity theory in its simpler form follows, for prices at any given time are obviously a function of the utilization of the money and credit then available.

<sup>1</sup> Put into words, the formula reads: The price index equals the money in circulation times its rate of turnover plus credit substitutes for currency—principally bank deposits—times their rate, divided by the number of physical units traded.

Perhaps the strongest objection that can be made to the theory is that, expressing a truism, it gives a misleading air of simplicity to complex facts. For as soon as one begins to search in market reports for values to substitute in the formula, difficulties enough appear. The most important term,  $M$ , is, however, easily obtained from the monthly statements of the Treasury. Credit available for circulation is somewhat more difficult to ascertain. Fundamentally, credit is contingent upon the future surplus earning power of capital and labor. Its theoretical potential volume is all such earning power, as currently estimated, discounted to the present. But though credit transactions are widespread, they practically all centralize into the banks. Where private credit is a substitute for money, the bank usually carries the burden, as when a firm financed by a bank extends credit to customers. Hence circulating credit may be estimated from bank reports, where private notes, secured by prospective income, are converted into deposits subject to check.

But though money and credit data involve no serious difficulties, the rate of circulation is another matter. It is said that recent estimates put the annual rate of turnover of money at twenty, and of deposits at forty. On this point further investigations are at present being made which promise results. But it has meanwhile become evident that the rate is by no means stationary, as once was thought. Perhaps the trend may be practically constant, as both Kemmerer's and King's studies assume, but it nevertheless appears certain that a marked change occurs during the course of the business cycle. Sometimes, it is true, the greater activity of spending is so correlated with a greater activity of trade that the two changes offset each other. This is probably the case with the active speculation that comes in the earlier stages of the business cycle. At such times money and stocks move so rapidly on the exchanges as almost to obscure the real functions of a securities market. Such activities are not important in their effects upon prices. But the fact that the rate of currency circulation prevailing throughout the country rises and falls with the progress of the business cycle, is highly important.

Though the cycle in the rate of currency circulation has not yet been adequately proved by statistics,<sup>1</sup> it may easily be inferred from detailed studies of the business cycle. In such studies it may be seen that bank reserves grow as a result of a period of depression. This growth, generally speaking, is due in part to a favorable turn in the balance of trade, in part to the check put upon gold consumption by its high price relative to income, and in part to the stimulus to gold production arising out of lowered costs, but most directly to the fact that lower prices and depressed business allow a larger part of the hand-to-hand circulation to flow back into the banks. In other words the velocity of currency circulation is low. Concurrently with large reserves, the interest rate is low, and loans and deposits are large in volume. Loans, however, are not large relative to reserves—a fact which indicates the surplus strength of the banks at such times. If, then, prices were governed directly by the creation of deposit currency, the rise of prices would be almost coincident with the increase of reserves. But in fact even stock prices lag noticeably after the maximum volume of reserves and loans, and commodity prices are still slower to move. What evidently occurs is that low discount rates and large loans, combined with the prevailing low prices and wages, gradually impart momentum to the sluggish business of a period of depression. The rate of currency circulation then increases, bringing with it a rise of prices as a consequence of the more active bidding for goods. The rising prices are favorable to profits, in part because of the fact that wages tend to lag, and in part to sales at a higher price level than that which prevailed when materials were purchased. Consequently business is further stimulated, and a spirit of active optimism prevails.

Again, at the downward turn of the cycle, it is evidently the rate of turnover of money that is the most immediate factor in bringing about the break in the price level. As prices move toward their climax, bank reserves are depleted, for reasons that are the converse of those just given for their previous increase. Consequently the banks raise their discount rates, and begin to force

<sup>1</sup> Brookmire's has begun the publication of an estimate based on New York bank deposits. It correlates markedly with bank clearings.

the liquidation of loans. The decline in profits caused by high discount rates is further accentuated by rapidly rising wages, which have been bid up at length by the continuance of business activity. With the reduction of profits the prevalent optimism gradually changes to gloom. As Professor Kemmerer has shown in his studies, business confidence is a very important factor in determining the use of credit, in as much as credit is essentially based upon an expectation of future earnings. It is also apparently as great a factor in determining the rate of spending. For with the change of mood, a "consumers' strike" is very likely to be precipitated. Seized suddenly with a spirit of thrift, the public holds back from spending, and business from the buying of producers' goods, labor, and stocks. The necessity of liquidating loans which can no longer be carried at the high discount rates, further cuts off buying, while intensifying the desire to sell. Prices consequently fall rapidly. The fall is, however, retarded by an accompanying diminution in the physical volume of trade and production, with a result that at length an equilibrium is again reached.

The more the subject of the rate of currency circulation is investigated, the more abstruse is it found to be. For it is soon discovered that behind the ebb and flow of business activity, with the accompanying reactions of the mechanism of banking, lies the adaptation of human energies to the resources of nature and of accumulated capital. Increased rapidity of spending is the superficial expression of a more intensive utilization of resources. But all production is a process of consumption, and of the transformation of utilities. Under any given set of conditions, this process has a normal rate which is contingent upon the power of recuperation from the fatigue of effort, the rate of ripening of biological forms of wealth, and in some cases a corresponding time element demanded by chemical and physical processes. Too rapid a pace brings, on the human side, a reaction in the form of a relaxation of effort, and a yielding to the spirit of self-indulgence. On the side of physical production, it may result in abnormal output in some lines as compared with others, and in many cases in the prospect of diminishing returns. It is this intangible necessity of adjustment of forces which is really brought into play in the

larger swings of business, and which expresses itself in an active or a retarded spending.

We come next to a consideration of the  $N$  in the formula—the volume of trade expressed presumably in physical units. This factor is obviously the physical volume of production increased by an uncertain coefficient expressing the rate at which the goods produced, together with permanent wealth, change hands. In *Money and Prices* Kemmerer has furnished a direct measurement of the growth of business, expressed as an index figure, for the years 1879 to 1908, inclusive. He has also computed for recent years an index of purely physical production—the first of such series to appear. Fisher has presented numerical estimates in connection with his expositions of the quantity theory. Mitchell has lately compiled a production index for recent years, and King has worked out a more elaborate series, beginning with 1880, showing both physical production and volume of trade. Finally, Day and Stewart have produced very accurate indices of physical production running back three or four decades.

There are certain inherent difficulties involved in the development of an index of physical production. The most apparent are the inadequacy of the data, and the problem of weighting for the earlier decades where the data are particularly scanty. These two difficulties are, however, not so very serious. It is possible to take six important items only, for which output and prices since the Civil War are continuously available, and by weighting appropriately for values and for the correlation of mining with manufactures, to obtain an index which parallels rather closely the results obtained by Day and Stewart—in fact, agreeing with them more closely than does King's index. Hence it appears that representative sampling is sufficient for practical purposes. A theoretical difficulty which may easily lead to erroneous conclusions is the fact that there is really no such thing as a composite unit of purely physical production. The only common denominator of pounds, yards, and bushels is a value unit. It is therefore necessary to weight physical output for value—preferably the average price for the whole period covered by the series of indices. The index of physical production is therefore identical with an index of value

production from which price fluctuations have been eliminated, and may sometimes be conveniently found by dividing value output by a price index. The physical unit is, then, a dollar's worth of a given commodity at a standard price; for example, if sugar at the standard price is eight cents a pound, then twelve and a half pounds of sugar constitute the physical unit so far as this one commodity is concerned. If weighting for value is not adopted, then a haphazard weighting is unavoidably inherent in the choice of the unit—whether pounds or tons are specified, for example.

But though the problem of measuring physical production may be regarded as solved, the related problem of the volume of trade—the  $N$  of the formula—has not been so satisfactorily attacked. Out of several undetermined elements, one may be selected for mention; namely, real estate transfers. Shares traded on the stock exchanges may be considered to bear a relation to this element but the connection is not definitely known. In as much as wealth represented by real estate is a much larger part of the total national wealth than is the annual commodity production, it may well be that such transfers are an important part of the volume of trade. At present, no adequate studies are at hand.

The quantity theory has often been misunderstood in respect to the method which it implies of combining the diverse items of business into a single index. It may be well to consider, therefore, the theory which underlies the process. Let us suppose that every item of purchase, by either money or credit, had been accurately recorded for a limited period of time, and that it was required to compute the price index of the formula in full. First, it would be necessary to change the physical units into units representing a dollar's worth of each class of goods at a standard price, as already discussed. We could now set down a series,

$$P = \frac{\text{Sales}}{\text{Units}}, \quad \frac{\text{Sales}}{\text{Units}}, \quad \frac{\text{Sales}}{\text{Units}}, \dots$$

and so on, for every class of goods traded. Next, the series of ratios of sales to units would be combined by adding the numerators and the denominators, respectively, and dividing the former by the latter sum. It is evident that if all sales had been at the standard price the index would be unity, since in each fraction

of the series the numerator would necessarily equal the denominator. But wherever prices were above the standard, sales in dollars would be larger than the number of units traded, and the ratio of the two items would be above unity. Similarly, a low price would be registered in a ratio below unity. The process of combining the ratios of sales to units by totaling numerators and denominators, respectively, is merely an averaging of the implied prices, weighting each for the number of units traded. This fact may easily be seen by attempting the latter operation. The composite value of  $P$  will, therefore, reflect price changes to the degree that a commodity with a variable price has entered into the volume of trade. Such an index, if it could be worked out completely, would evidently not be quite identical with the ordinary producers' or consumers' indices, but would doubtless be somewhat closely concurrent with them.

Such is the nature of the price index which the quantity theory implicitly contemplates, and which is approximated in computations based upon the formula. For the money and credit currencies, multiplied by their respective rates, give the aggregate sales in dollars, and the  $N$  of the formula is merely the number of units traded, assuming the unit to be a dollar's worth of the goods in question at a standard price. The totaling of sales and units, and the use of their ratio as an index, is a typical process of finding a weighted average. The result may be called an index of trade prices.

A second common misunderstanding of the quantity theory may be referred to. Certain economists have held as a counter theory that the value of money—and therefore the range of prices—depends upon the commodity value of the standard metal, which value, in turn, tends to equate with the cost of production. It should be evident that the quantity theory does not at all controvert this fact, but merely explains the mechanism by which the level of prices tends to be brought into accord with the value of gold in the arts and at the mine. Perhaps the point may be best stated by a description of recent price changes.

Prior to 1914 prices had been gradually rising, principally because improved methods of gold mining were bringing a larger output into the monetary market. Gold was cheapening, both in the arts and as money. The rising prices were, however, acting

as a partial check upon the increasing gold production, in that labor and materials were becoming more expensive in terms of gold. In 1914, business was in a depressed condition from which the stir of war activities soon awoke it. The course of prices in Europe needs no discussion, since in the main it represents merely the familiar process of credit inflation. In America, the prospects of great munition orders quickly began to stimulate business. Whether prices began to rise before the incoming of money and credit from abroad, is uncertain. They might theoretically have done so, merely through the increased rate of circulation that comes with improved confidence and prospects, and the greater use of credits. But apparently prices rose almost simultaneously with the gold importations, which by 1917 amounted to about a billion dollars. At the same time the creation of the Federal Reserve System had made possible an economy of gold in reserves, so that the volume of credits, both in the form of bank notes and of deposits, could be swelled to large proportions. Credits were consequently created, particularly for the use of the government in financing its military operations. But, even without this outlet, credit based upon the surplus reserves would doubtless have been extended to business at rates sufficiently low to induce its extended use; otherwise, gold reserves would have piled up enormously. The resulting high prices, quite in accord with theory, induced an exceptionally large use of gold in the arts, particularly during the extravagance of the post-war boom. They also reacted so decisively upon gold producers as to call forth from them a demand for a government bounty to stimulate the declining production. The exportation of gold was also temporarily induced.

Thus in the usual ways credit inflation and high prices brought a gradual easing of the gold surplus. After the reserve had begun to approach its legal limit, the banks began a movement toward credit contraction, with the results that deposit currency has been lessened, and the spirit of extravagant optimism broken. Though money continued to increase somewhat through most of 1920, the peak of circulation—money plus twice deposits—was, according to King's figures, reached during December, 1918, and January and February, 1919. During the spring and summer of 1919, wholesale prices began a decline which assumed notable propor-

tions by the end of the year, and retail prices have already begun to follow. Probably more immediately responsible for the break in prices was the lessening in the rate of spending, which took the form of a marked "consumers' strike." Producers also checked their buying, while the decline in their physical output tended somewhat to retard the fall of prices. It is evident that the price decline will eventually throw money back into the banks and bring encouragement to the gold producer. With greater reserves, the banks will again loan at a low rate, and the sluggish production and the general pessimism will yield to a renewed activity. But as Europe gradually gets back to its former status, and begins to call in as reserves and circulation the war-cheapened gold which it flung upon the world-market, we may expect that for a time gold will be high, prices prevailingly low, and the gold producer active. Thus, as long as the gold standard is in force, the level of prices necessarily adjusts itself to the value of gold in the arts and to the cost of its production. Redundant currency eventually pushes up prices, and the more valuable standard metal is driven out and cheapened, until the redundancy is relieved. Conversely, a lack of gold reserves leads to credit contraction and low prices, and so brings in gold. Credit issues must necessarily be so adjusted as to maintain or restore the natural equilibrium between the bullion value of gold and its cost of production.

By way of valuation, it may be said that the quantity theory, when properly interpreted and applied, has proved valid and useful. If doubters still remain, they may turn to the elaborate proofs worked out by Professor Kemmerer, and recently by Professor King. In the opinion of the writer, these studies are valuable, not primarily because they supply proof for an axiomatic proposition, but because they furnish a statistical description of the course of business, and make intelligible the movements of prices. It is in such studies, and in the predictions which they make possible, that the real value of the quantity theory may be seen. The formula serves to focus in a concise form the group of factors involved in general markets. It does not explain markets any more than the multiplication table explains engineering problems, but it is nevertheless a useful tool in the systematization of price data.

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